UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Alaska Fisheries Science Center
Resource Assessment and Conservation
Engineering Division
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F/T CONTINUITY
Cruise No. 91-01
Echo Integration-Midwater Trawl Survey of Pollock on the Eastern Bering Sea Shelf

CRUISE PERIOD, AREA, AND SCHEDULE

Scientists from the Alaska Fisheries Science Center (AFSC) conducted an echo integration-midwater trawl (EIMWT) survey of walleye pollock (Theragra chalcogramma) aboard the chartered factory trawler Continuity from June 22 to August 31, 1991, for a total of 71 sea days. The cruise began in Kodiak, Alaska, and ended in Dutch Harbor, Alaska. The area of operations covered the eastern Bering Sea (EBS) continental shelf from the Aleutian Island chain north to the U.S./U.S.S.R. Convention Line. This survey was part of a triennial effort begun in 1979 to assess the demersal and pelagic components of the walleye pollock population in waters over the EBS shelf and slope during the summer months. The bottom trawl assessment was carried out by three vessels--R/V Alaska, F/V Ocean Hope 3, and R/V Miller Freeman. The U.S. survey effort was coordinated with scientists from the Japan Fisheries Agency aboard the F/V Shoyo Maru conducting an EIMWT survey of the Aleutian Basin east of the U.S./U.S.S.R. Convention Line.

The F/T Continuity's itinerary was as follows:

June 17-23	Vessel loading and equipment installation in Kodiak.
	Leg 1
June 24-26	Tests with hull-mounted transducer; sphere calibration of the acoustic system in Three Saints Bay.
June 27-29	Transit to Bering Sea; trawl gear trials en route.

June 30-July 7	Primary EIMWT survey of EBS shelf east of longitude 167° W.
July 8-9	Inport Dutch Harbor to exchange scientists and refuel.
July 10-30	Primary EIMWT survey of EBS shelf between longitudes 167° W and 175° 30' W.
July 31	Inport St. Paul to exchange scientists and refuel.

Leg 2

August 1-10	Primary EIMWT survey of EBS shelf west of longitude 175° 30' W.
August 10-13	Replicate EIMWT survey of EBS shelf west of longitude 174° 30' W.
August 13-16	Intership calibration with Japanese F/V Shoyo Maru.
August 16-19	Replicate EIMWT survey of EBS shelf between longitudes 174° 30' W and 170° 30' W.
August 20	Refueling in St. Paul.
August 20-29	Replicate EIMWT survey of EBS shelf east of longitude 170° 30' W.
August 30	Sphere calibration of the acoustic system in Makushin Bay.
August 31	Disembark scientists in Dutch Harbor; charter ends.

OBJECTIVES

The principal objectives of the cruise were to:

1. Collect echo integration data and midwater and demersal trawl data necessary to determine the distribution, biomass, and biological composition of walleye pollock in the area of operations.
2. Collect pollock acoustic target strength data.
3. Collect pollock tissue samples (gonad and liver) for stock structure studies.

4. Calibrate the acoustic system using standard sphere techniques.

5. Conduct an experiment to investigate the reaction of pollock to bottom and midwater trawl gear during both day and night.

6. Collect samples of age 0 pollock for birthdate estimation research.

7. Conduct an intership calibration of the acoustic systems aboard the U.S. survey vessel F/T Continuity and the Japanese survey vessel F/V Shoyo Maru.

8. Record observations of lamprey scars on pollock flesh as part of a study to determine the use of lamprey scars as a tag in stock structure research.

9. Collect samples of squid for a marine mammal project.

10. Collect stomach contents data for the pollock food habits database.

11. Collect echo integration data along selected transect sections during both day and night to investigate diel effects on abundance estimation.

VESSEL, ACOUSTIC EQUIPMENT, AND TRAWL GEAR

The survey was conducted on board the U.S. F/T Continuity, a 41-m (134-ft) catcher-processor with two main engines of 750 hp each. Acoustic data were collected with a 38 kHz echo sounding system (Simrad EK500[1]). A Simrad split beam transducer was fixed in a dead-weight fin and towed at a depth of 15-25 m below the surface approximately 40 m behind the vessel. System electronics were housed in a portable laboratory mounted on the weather deck of the vessel. Data from the Simrad EK500 echo sounder/receiver were processed using Simrad BI500 echo integration and target strength data analysis software on a SUN workstation.

Midwater echosign was sampled using a modified Northern Gold 1200 midwater rope trawl (NET Systems, Inc.). The trawl was constructed with ropes in the forward section and stretch mesh sizes ranging from 163 cm (64 inches) immediately behind the rope section to 8.9 cm (3.5 inches) in the codend. It was fished in a bridleless configuration and was fitted with a 3.2-cm (1.25-inch) mesh codend liner. Headrope and footrope lengths were 94.5 m (310 ft) and 50 m (164 ft), respectively, and the breastlines measured 79.4 m (260.5 ft). The headrope length was measured between the points of attachment to the

[1] Reference to trade names or commercial firms does not constitute U.S. government endorsement.

dandylines. The footrope length was measured between the points where the tom weights are attached. The breastline length was measured from the headrope dandyline attachment point to the footrope tom weight attachment point. The net was fished with 1.8 m X 2.7 m (6 ft X 9 ft) steel V-doors and 227-kg (500-lb) tom weights on each side. Trawl mouth opening and depth were monitored with a Furuno wireless netsounder system attached to the headrope of the trawl.

Two additional trawls were used. Fish on and near bottom were sampled with an 83/112 bottom trawl without roller gear. The bottom trawl had mesh sizes ranging from 10.2 cm (4 inches) forward to 8.9 cm (3.5 inches) in the codend and a 3.2-cm (1.25-inch) codend liner. Headrope and footrope lengths were 25.6 and 34.1 m (83.9 ft and 111.9 ft), respectively. Breastlines measured 3.4 and 3.2 m (11.3 and 10.5 ft). Age 0 fish in midwater were sampled with a Marinovich midwater trawl, with meshes measuring 7.6 cm (3.0 inches) forward, 3.2 cm in the codend, and a 0.32-cm (1/8-inch) codend liner. Headrope and footrope lengths were each 9.1 m (30 ft). The Marinovich trawl and the 83/112 demersal trawl were fished with the same steel V-doors used with the rope trawl. Trawl mouth opening and depth were monitored with the Furuno netsounder system.

Water temperature/salinity profile data were collected at trawl and calibration sites using a Seabird CTD (conductivity/ temperature/depth) system. Expendable bathythermographs (XBT) were launched routinely during the survey period to provide additional temperature profile data.

SURVEY METHODS

Prior to the start of survey operations, gear trials with a prototype hull-mounted transducer system were conducted off Kodiak Island. The trials were not successful so the towed vehicle system was chosen as the primary acoustic data collection system for the survey.

Two surveys of the EBS shelf were completed during this cruise. The primary survey with north-south transects spaced 20 nmi apart began in Bristol Bay and proceeded to the northwest (Figure 1). Primary survey transects were chosen to coincide with lines of groundfish trawl stations sampled by the demersal survey vessels. The replicate survey with north-south transects spaced at 40 nmi apart began near the U.S./U.S.S.R. Convention Line and proceeded to the southeast (Figure 2). Replicate survey transects were placed midway between alternate pairs of the primary survey transects. The southern extent of both primary and replicate survey transects was the edge of the continental shelf--except for the easternmost transects limited approximately by the 35-fm bottom depth contour along the Aleutian chain. The northern extent roughly coincided with

the disappearance of adult pollock echosign--except for those westernmost transects cut short by the U.S./U.S.S.R. Convention Line. On the vessel's return to St. Paul at the end of Leg 1, two additional transects were surveyed. One transect was halfway between primary transects 18 and 19 and the other was between primary transects 17 and 18.

Survey operations were conducted both day and night. During the primary survey, if significant pollock echosign was encountered during nighttime operations, that section of trackline was resurveyed during daylight hours. During the replicate survey, no nighttime transect sections were repeated during the day. Vessel speed averaged about 7 knots and varied between 5 and 8 knots, depending upon weather conditions. The acoustic system collects echo integration data and split beam target strength data at the same time. The target strength data provide information about the acoustic characteristics of the fish under observation. These data will be interpreted together with historical target strength data and then used to scale echo integration data to provide estimates of surface density (kg/m^2).

Midwater and demersal trawl hauls were made at selected locations to identify echosign and provide biological samples. The average trawling speed was about 3 knots. Vertical net opening for the midwater rope trawl averaged 18 m and ranged between 15 and 20 m. The net opening for both the Marinovich midwater and 83/112 demersal trawls was about 3 m. Standard catch sorting and biological sampling procedures were used to provide estimates of weight and number by species for each haul. Pollock were further sampled to determine sex, length, body weight, age, maturity, gonad weight, stomach composition, and incidence of lamprey scars. In certain areas, pollock tissue samples were collected and preserved (frozen) for stock structure studies. Samples of age 0 pollock were preserved (frozen) for a birthdate estimation study.

Standard sphere calibrations were conducted in Three Saints Bay, Kodiak Island, on June 26 prior to the start of the survey and in Anderson Bay, Unalaska Island, on August 30 at the end of the survey. At each location, the vessel was anchored fore and aft to keep the ship from moving during the data collection. Calibration involved suspending a copper sphere with known acoustic properties below the transducer. Data were collected with the transducer at several fin depths (i.e. 5, 10, 15, 20, and 25 m) to measure any changes in system sensitivity due to pressure effects on the transducer.

After a full day of searching for suitable echosign, an intership calibration of the U.S. and Japanese acoustic systems was conducted on August 14-16 in an area approximately 80 nmi

west-northwest of St. Paul Island. The vessels' navigational instruments were calibrated prior to the start of data collection to ensure that position information would be comparable. Vessel speeds averaged 6 knots and ranged between 5 and 7 knots. The two vessels alternated side-by-side with follow-the-leader configurations. For the first transect, the Shoyo Maru was 0.1 nmi to port of the Continuity; on the return, the vessels maintained the same relative position with the Shoyo Maru traveling the original path of the Continuity. The next set of transects began with the Continuity following 0.5 nmi behind the Shoyo Maru. The Continuity led on the return transect. This pattern of data collection continued for a total of 32 hours.

Efforts to conduct an experiment to investigate the reaction of pollock to trawl gear were unsuccessful. The required combination of workable sea state and suitable fish situation was never encountered during the cruise. An experiment of this type will be attempted again in Shelikof Strait in the winter of 1992.

PRELIMINARY RESULTS

Standard Sphere Calibrations

The pre-survey standard sphere calibration was conducted in Three Saints Bay on June 26. The post-survey calibration took place in Anderson Bay on August 30. The standard sphere (38.6 mm diameter) used was made of copper and had a known target strength of -33.6 dB. Split beam target strength and echo integration data were collected with the Simrad EK500 system. Data were also collected to describe transducer beam pattern characteristics by moving the standard sphere through the beam. In Three Saints Bay, measurements were made with the fin/transducer positioned at depths of 5, 10, 15, and 20 m from the surface. There was no significant difference in the measurements made at these four depths. In Anderson Bay, data were collected with the fin/transducer positioned at depths of 10, 15, 20, and 25 m. Again, there was no appreciable difference between the four depths. However, there was a 0.5 dB change in system sensitivity from the June 26 calibration. This change is most likely explained by a tow cable switch effected on August 17. Continuous monitoring of the transducer's transmit current alerted us to a problem in the original cable. The faulty cable was replaced with a backup cable and the survey continued.

Intership Calibration

The intership calibration was conducted on August 14-16 in a 225 sq nmi area centered near 57° 45' N and 172° 45' W. The bottom depth in this area was approximately 150 m. Fish sign extended from the bottom to within 40 m of the surface. A

near-surface scattering layer was also observed. A total of 13 pairs of transects were completed. Transects averaged 10.7 nmi in length and ranged between 7.5 and 14.0 nmi. From the echo integration data collected, average water column S_A (area backscattering coefficient) values were estimated for each transect. Originally, it was agreed to compare S_A averages for that portion of the water column from 25 m below the surface to within 2 m of the bottom. To avoid any problem with the near-surface layer, this was changed during data collection on the fourth transect to 40 m from the surface to within 2 m of the bottom. Preliminary analysis of the data reveals little difference between the Japanese and U.S. acoustic systems.

Biological and Oceanographic Data Collection

Biological data were collected and specimen and tissue samples preserved throughout the survey area. Trawl station and catch data from 53 midwater (including 42 rope and 11 Marinovich) and 20 demersal trawl hauls are summarized in Table 1. Pollock was the dominant fish species captured in both midwater and demersal trawl hauls (Tables 2-4). The major non-pollock component in both rope trawl and Marinovich trawl catches was jellyfish. Pacific cod, arrowtooth flounder, and flathead sole were captured in significant quantities along with pollock in the bottom trawl hauls. Tallies of biological data collected for pollock are presented in Table 5. Age 0 pollock samples from a total of 11 trawl hauls were preserved for birthdate estimation studies. Gonad and liver tissue samples from 137 adult pollock were collected from a total of 7 trawl hauls for stock structure studies. Oceanographic data collection consisted of a total of 63 CTD casts (Table 6) and 54 XBT casts (Table 7, Figure 3).

EIMWT Surveys

The primary EIMWT survey of the shelf was conducted from June 30 to August 10. The trackline consisted of 24 north-south transects spaced 20 nmi apart. Trackline mileage (including cross transects) totalled 4,092 nmi. Pollock echosign was detected over the entire survey area. The area east of longitude 168° W (i.e. transects 1-9) accounted for a little less than 1/3 of the total preliminary unscaled biomass. The area west of longitude 171° 10' W (i.e. transects 15-24) contained slightly less than 2/3 of this total. The intermediate area in the vicinity of the Pribilof Islands (i.e. transects 10-14) contained approximately 5% of the total. The depth of pollock echosign in the water column varied considerably throughout the survey area. In some areas, most of the fish sign was found within 10 m of the bottom; while in others, very little echosign was found near bottom.

The replicate EIMWT survey of the shelf was conducted August 10-28. The trackline consisted of 11 north-south

transects spaced 40 nmi apart. Trackline mileage (including cross transects) totalled 2,056 nmi. The geographic and depth distributions of echosign during the replicate survey were similar to that observed during the primary survey.

A total of 50 trawl hauls were made during the primary survey to sample echosign (Figure 4). Of these, 16 were demersal tows using the 83/112 bottom trawl; 8 were Marinovich midwater tows; and the remaining 26 were midwater tows with the rope trawl. During the replicate survey, 23 tows were made--4 demersal, 3 Marinovich midwater, and 16 midwater with the rope trawl (Figure 5).

The size composition of pollock in demersal trawl catches differed from that observed in midwater rope trawl catches. Of the 20 bottom trawl catches obtained, 16 were composed almost entirely of pollock > 40 cm in length (e.g. Haul 64, Figure 6). The remaining four demersal trawl catches contained some 1-year-old pollock (e.g. Haul 35, Figure 6) or 2-year-old pollock (e.g. Haul 3, Figure 6) along with the larger fish. Of the 42 mid-water trawl catches, only 8 contained significant quantities of pollock > 40 cm. One- and 2-year-old pollock were encountered over all parts of the shelf (e.g. Haul 2, Figure 6). Significant quantities of 2-year-old fish were found in 28 of the midwater trawl catches. During the primary survey, almost no pollock between 30 and 40 cm were found east of 173° 40' W. This size range was encountered only in the northwest part of the survey area (e.g. Haul 44, Figure 6).

It is of interest to note the apparent growth exhibited by the 1- and 2-year-old fish over the course of the survey. Hauls 2, 66, and 72 are relatively close to each other geographically (Figures 4 and 5). Haul 2 occurred at the beginning of the survey on July 2; while Hauls 66 and 72 were made at the end of the survey period on August 26 and August 29, respectively. The modal length of 1-year-old fish in early July was 15 cm and at the end of August it was 21 cm--an increase of 6 cm (Figure 6). The modal length of 2-year-old fish increased from 26 cm to 29.5 cm over the same time period.

The Marinovich trawl hauls were intended to sample age 0 fishes. The catch from a typical Marinovich trawl haul consisted mainly of jellyfish together with a small quantity of age 0 pollock. These age 0 fish ranged in length from 14 to 87 mm. Fish captured late in August were quite a bit larger (i.e. modal length ~ 70 mm) than those captured in early July (i.e. modal length ~ 30 mm).

Maturity stage was assigned to a sample of 2,065 pollock examined during the course of the survey. Most of the adult fish had probably spawned during the winter/spring period and their gonads were now in a redeveloping phase. Of 942 female pollock examined, only 1 fish was found to be in spawning condition.

SCIENTIFIC PERSONNEL

Name	Sex/ Nationality	Position	Organization
Leg 1 (June 24-July 31)			
Ed Nunnallee	M/USA	Chief Scientist	AFSC
Dan Twohig	M/USA	Elec. Technician	AFSC
John Garrison	M/USA	Elec. Technician	AFSC
Joe Klein	M/USA	Fish. Biologist	AFSC
Dave Skordal	M/USA	Bio. Technician	AFSC
Jim Traynor	M/USA	Fish. Biologist	AFSC (6/24-7/8)
Steve de Blois	M/USA	Fish. Biologist	AFSC (7/8-31)
Leg 2 (August 1-31)			
Neal Williamson	M/USA	Chief Scientist	AFSC
Dan Twohig	M/USA	Elec. Technician	AFSC
Taina Honkalehto	F/USA	Fish. Biologist	AFSC
Dennis Benjamin	M/USA	Bio. Technician	AFSC
Steve de Blois	M/USA	Fish. Biologist	AFSC
Dave Skordal	M/USA	Bio. Technician	AFSC

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Table 1. Trawl station and catch data for the summer 1991 EIMWT survey of the EBS shelf, Continuity cruise 91-1.

HAUL NO	HAUL TYPE[3]	DATE (1991)	TIME (ADT)	LAT. (N)	LONG. (W)	TEMP. (C) SURF	TEMP. (C) GEAR	DEPTH (FM) GEAR	DEPTH (FM) BOTT	CATCH (LBS/NOS)[2] WALLEYE POLLOCK	CATCH (LBS/NOS)[2] AGE 0 POLLOCK	CATCH (LBS/NOS)[2] OTHER
1	MW	30 JUN	1033-1041	55 49.4	163 24.3	6.8	1.3	47	50	4124/13802		86/86
2	MW	2 JUL	0838-0840	56 12.4	164 35.9	6.6	2.1	48	50	1164/ 4318		65/1
3	BT	2 JUL	0941-0951	56 13.2	164 36.0	6.6	2.1	52	52	2339/ 2030		521/477
4	MW	3 JUL	0012-0058	54 38.5	165 09.0	6.3	5.3	48	49	378/ 184		502/4
5	BT	4 JUL	1016-1041	55 27.1	165 45.9	8.2	3.8	66	66	1345/ 512		1626/1688
6	MA	4 JUL	1214-1314	55 28.7	165 46.4	8.2	6.2	10	66	2/ 9	2/903	50/8
7	MW	5 JUL	1049-1103	55 32.8	166 22.0	9.1	3.8	65	71	1225/ 3196		118/2
8	BT	5 JUL	1202-1232	55 32.2	166 22.1	9.1	3.8	71	71	1317/ 555		1133/1838
9	MA	5 JUL	2026-2126	56 31.0	166 26.0	9.6	5.7	15	55		2/3213	200/0
10	MA	6 JUL	1001-1046	56 59.4	167 06.7	8.4	4.6	8	41	T/ 1	1/2090	200/0
11	MW	6 JUL	1139-1159	56 55.9	167 05.9	8.4	3.0	20	41	5/ 3		502/1
12	BT	6 JUL	1300-1310	56 56.8	167 05.3	8.4	3.0	41	41	482/ 177		509/428
13	MW	6 JUL	2044-2144	56 16.2	166 59.8	10.2	3.5	61	65	285/ 157		200/0
14	MW	7 JUL	0900-0921	55 32.6	166 58.7	10.2	3.4	59	75	1125/ 1722		
15	MW	10 JUL	1232-1315	55 08.2	167 32.3	8.4	3.6	106	124	44/ 24		1/0
16	MW	11 JUL	1053-1107	57 36.3	167 45.0	9.4	3.4	34	39	6/ 4		201/1
17	MA	11 JUL	1555-1630	57 39.9	168 26.6	10.4	3.1	22	39		2/3381	151/1
18	BT	12 JUL	1327-1403	55 55.2	168 12.8	10.4	3.4	80	80	419/ 167		1971/574
19	MA	14 JUL	2119-2141	56 12.4	170 02.5	8.7	6.4	15	65		1/2178	150/0
20	MA	15 JUL	1444-1514	58 00.2	170 20.1	8.8	3.6	14	42			350/0
21	BT	16 JUL	1114-1150	57 23.3	170 51.1	8.6	2.9	47	47	582/ 260		2538/908
22	BT	17 JUL	1217-1228	56 34.8	171 18.0	8.6	3.4	68	68	3791/ 1865		209/380
23	BT	19 JUL	0513-0543	57 49.9	172 11.8	9.0	2.3	59	59	4732/ 2769		559/649
24	MW	19 JUL	1053-1107	57 26.0	172 07.0	9.1	2.8	59	60	2002/ 5442		8/8
25	MW	20 JUL	0719-0739	57 00.4	172 37.7	8.7	2.9	65	68	2379/ 6540		1/1
26	BT	20 JUL	1003-1045	56 49.4	172 36.5	8.7	2.9	72	72	2805/ 1692		1615/3001
27	MW	20 JUL	1903-1920	57 33.7	172 45.6	9.2	2.7	64	67	20000/53647		
28	MW	21 JUL	1308-1338	58 50.0	173 02.0	8.9	1.5	58	61	102/ 69		13/8
29	BT	21 JUL	1426-1455	58 49.2	173 00.2	8.9	1.5	62	62	5100/ 3127		1440/605
30	MW	24 JUL	0805-0812	58 18.3	173 32.8	8.6	2.0	60	64	9150/28352		
31	BT	24 JUL	1221-1236	57 57.5	173 29.0	8.9	2.2	66	66	2763/ 1661		267/417
32	BT	25 JUL	1539-1554	58 29.4	174 11.3	9.0	2.5	73	73	3499/ 1908		601/496
33	MW	26 JUL	0045-0105	59 22.4	174 26.1	8.6	1.3	45	65	2920/ 3017		
34	MA	26 JUL	1040-1120	59 42.3	174 31.3	8.2	4.6	9	63		1/1080	400/0

[2] T = trace (i.e. < 1 lb)

[3] MW = midwater rope trawl; BT = bottom trawl; MA = Marinovich trawl

Table 1 (continued). Station and catch data for the summer 1991 EIMWT survey of the EBS shelf, Continuity cruise 91-1.

HAUL NO	HAUL TYPE	DATE (1991)	TIME (ADT)	LAT. (N)	LONG. (W)	TEMP. (C) SURF	TEMP. (C) GEAR	DEPTH (FM) GEAR	DEPTH (FM) BOTT	CATCH (LBS/NOS) WALLEYE POLLOCK	CATCH (LBS/NOS) AGE 0 POLLOCK	CATCH (LBS/NOS) OTHER
35	BT	27 JUL	1129-1144	59 33.0	175 10.2	8.3	1.8	70	70	1661/ 1481		489/483
36	MW	28 JUL	1230-1310	58 07.6	173 50.1	9.0	2.3	43	63	2580/19146		
37	BT	28 JUL	1400-1415	58 11.4	173 50.5	9.0	2.6	63	63	4790/ 6870		270/398
38	BT	29 JUL	1007-1025	56 36.1	172 49.0	9.4	3.3	77	77	6615/ 3295		585/612
39	MW	2 AUG	1814-1850	59 13.0	175 43.7	9.3	1.3	74	77	5044/11031		6/8
40	MW	3 AUG	0950-1010	59 44.5	175 55.3	8.7	1.6	75	77	306/ 339		16/9
41	MW	3 AUG	2305-2316	60 50.6	176 13.2	9.9	-0.2	59	65	1800/ 6978		50/22
42	MA	4 AUG	1818-1851	61 55.5	176 32.6	10.2	-1.6	37	58			8/8
43	MW	5 AUG	1015-1049	60 48.8	176 53.8	10.2	-1.5	19	70	1371/ 8935		379/0
44	MW	6 AUG	1643-1658	58 36.6	176 09.5	9.9	2.4	82	89	1415/ 3115		3/6
45	BT	6 AUG	1810-1825	58 36.7	176 11.1	9.9	2.4	89	89	3116/ 2004		434/200
46	MW	7 AUG	1226-1500	59 08.2	177 00.0	9.8	1.6	74	79	1064/ 3336		34/24
47	MW	8 AUG	0110-0115	60 00.0	177 20.1	9.3	0.8	50	77	1880/ 6857		8/6
48	MW	8 AUG	2009-2109	61 07.8	177 40.6	10.0	0.5	49	79	155/ 1043		8/11
49	MW	9 AUG	1117-1120	60 33.4	178 08.8	10.0	1.1	59	89	291/ 1386		4/10
50	MW	9 AUG	1239-1254	60 33.1	178 08.8	10.0	1.1	84	88	385/ 1440		26/4
51	MW	10 AUG	0830-0906	58 36.2	177 03.7	9.2	2.9	93	135	871/ 2951		
52	MW	11 AUG	1425-1445	61 16.8	177 23.9	10.6	0.6	67	71	602/ 533		27/39
53	BT	11 AUG	1545-1600	61 16.2	177 23.9	10.6	0.6	71	71	3666/ 2444		134/49
54	MW	12 AUG	0750-0820	60 15.2	175 42.3	8.7	0.8	61	66	2676/ 5315		74/1
55	MA	12 AUG	1320-1350	59 54.7	175 35.7	9.3	9.0	12	70		1/163	280/5
56	MW	13 AUG	0008-0034	58 56.0	175 18.5	9.1	2.3	53	74	231/ 1697		12/1
57	MW	14 AUG	1319-1403	57 44.1	172 45.1	9.5	2.8	53	65	29/ 255		T/3
58	MW	17 AUG	0251-0324	58 41.5	173 57.6	9.4	2.3	49	75	606/ 2327		17/18
59	MW	18 AUG	1027-1113	58 12.7	172 36.3	9.8	4.3	20	58		1/175	479/6
60	MW	20 AUG	2250-2305	57 30.1	171 11.6	9.0	6.7	13	52		1/75	2549/0
61	MW	21 AUG	0127-0147	57 35.5	171 12.9	8.9	3.4	46	52	2577/ 26344		473/176
62	MW	22 AUG	1929-1946	55 37.6	168 28.9	8.7	4.7	69	79	578/ 1043		39/1
63	MW	24 AUG	1139-1154	55 37.4	167 17.0	9.1	3.5	67	75	1729/ 4231		21/11
64	BT	24 AUG	1641-1700	55 14.9	167 15.4	10.0	3.5	81	81	3082/ 1315		268/182
65	MW	24 AUG	2056-2117	55 04.7	167 14.8	7.5	3.9	72	90	865/ 1924		12/0
66	MW	26 AUG	1311-1315	56 45.3	165 20.0	9.7	2.2	35	42	12360/24356		462/20
67	MA	26 AUG	1854-1926	56 32.0	164 53.5	9.9	9.4	11	43		28/4613	712/130
68	BT	27 AUG	0730-0807	55 10.9	164 52.1	8.4	4.8	60	60	2730/ 992		720/484
69	MW	28 AUG	0402-0431	56 27.9	163 42.4	9.8	1.7	20	45	15619/31796		381/0
70	MA	28 AUG	1408-1414	56 40.4	163 42.0	10.2	2.6	14	42		13/1857	289/19
71	MW	28 AUG	1800-1816	56 57.6	163 41.7	10.4	2.4	32	38			6049/10
72	MW	29 AUG	0951-1013	55 27.7	165 23.0	-	-	56	62	49/ 253		182/0
73	BT	29 AUG	1108-1136	55 28.0	165 21.5	-	-	63	63	1662/ 1062		613/482

Table 2. Summary of catch by species in midwater rope trawls obtained from the eastern Bering Sea shelf during the summer 1991 EIMWT survey, Continuity cruise 91-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Walleye Pollock (Theragra chalcogramma)	101917.2	88.4	291128	99.8
Jellyfish Unidentified (Scyphozoa)	13167.5	11.4	-	-
Pacific Herring (Clupea pallasii)	44.0	<.1	76	<.1
Smooth Lumpsucker (Aptocyclus ventricosus)	36.7	<.1	11	<.1
Pacific Cod (Gadus macrocephalus)	25.1	<.1	3	<.1
Skate Unidentified (Rajidae)	18.0	<.1	1	<.1
Yellowfin Sole (Limanda aspera)	8.5	<.1	10	<.1
Atka Mackerel (Pleurogrammus monopterygius)	3.8	<.1	8	<.1
Arrowtooth Flounder (Atheresthes stomias)	1.5	<.1	2	<.1
Shrimp Unidentified	1.4	<.1	177	0.1
Magistrate Armhook Squid (Berryteuthis magister)	1.0	<.1	1	<.1
Prowfish (Zaprora silenus)	0.8	<.1	2	<.1
Flathead Sole (Hippoglossoides elassodon)	0.8	<.1	1	<.1
Basketstarfish Unidentified	0.4	<.1	1	<.1
Squid Unidentified	0.3	<.1	8	<.1
Capelin (Mallotus villosus)	0.1	<.1	1	<.1
Bering Wolffish (Anarhichas orientalis)	0.1	<.1	1	<.1
Poacher Unidentified (Agonidae)	0.1	<.1	1	<.1
Totals	115227.3	100.0	291432	100.0

Table 3. Summary of catch by species in bottom trawls from the eastern Bering Sea shelf obtained during the summer 1991 EIMWT survey, Continuity cruise 91-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Walleye Pollock (Theragra chalcogramma)	56494.9	77.4	36186	71.6
Pacific Cod (Gadus macrocephalus)	3993.4	5.5	577	1.1
Arrowtooth Flounder (Atheresthes stomias)	3682.1	5.0	2715	5.4
Flathead Sole (Hippoglossoides elassodon)	2389.9	3.3	5013	9.9
Skate Unidentified (Rajidae)	1594.1	2.2	108	0.2
Rock Sole (Lepidopsetta bilineata)	703.2	1.0	632	1.3
Sculpin Unidentified (Cottidae)	703.1	1.0	205	0.4
Gastropod Unidentified	491.8	0.7	699	1.4
Alaska Plaice (Pleuronectes quadrituberculatus)	486.0	0.7	127	0.3
Tanner Unidentified (Chionoecetes sp.)	321.2	0.4	1044	2.1
Bairdi Tanner Crab (Chionoecetes bairdi)	307.8	0.4	532	1.1
Opilio Tanner Crab (Chionoecetes opilio)	307.3	0.4	323	0.6
Yellowfin Sole (Limanda aspera)	290.6	0.4	402	0.8
True Tanner Crab (Chionoecetes tanneri)	286.8	0.4	574	1.1
Pacific Halibut (Hippoglossus stenolepis)	204.0	0.3	17	<.1
Jellyfish Unidentified (Scyphozoa)	136.8	0.2	-	-
Rex Sole (Glyptocephalus zachirus)	128.8	0.2	130	0.3
Basketstarfish Unidentified	89.4	0.1	167	0.3
Starfish Unidentified	60.4	0.1	202	0.4
Invertebrates Unidentified	56.4	0.1	197	0.4
Kamchatka Flounder (Atheresthes evermanni)	48.9	0.1	32	0.1
Octopus Unidentified	46.0	0.1	8	<.1
Eelpout Unidentified (Zoarcidae)	32.1	<.1	115	0.2
Crab Unidentified	23.5	<.1	62	0.1
Hermit Crab Unidentified (Paguridae)	22.0	<.1	-	-
Eulachon (Thaleichthys pacificus)	21.7	<.1	200	0.4
Chum Salmon (Oncorhynchus keta)	17.0	<.1	3	<.1
Dover Sole (Microstomus pacificus)	14.7	<.1	29	0.1
Pacific Herring (Clupea pallasii)	9.4	<.1	19	<.1
Greenland Turbot (Reinhardtius hippoglossoides)	6.0	<.1	9	<.1
Poacher Unidentified (Agonidae)	5.3	<.1	42	0.1
Sea Anemone Unidentified (Actiniaria)	4.7	<.1	42	0.1
Starry Flounder (Platichthys stellatus)	4.0	<.1	1	<.1

Table 3 (continued). Summary of catch by species in bottom trawls from the eastern Bering Sea shelf obtained during the summer 1991 EIMWT survey, Continuity 91-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Sea Urchin Unidentified	3.5	<.1	20	<.1
Ronquil Unidentified (Bathymasteridae)	2.3	<.1	5	<.1
Pacific Ocean Perch (Sebastes alutus)	2.0	<.1	1	<.1
Snailfish Unidentified (Cyclopteridae)	1.8	<.1	4	<.1
Tunicate Unidentified	1.0	<.1	1	<.1
Shrimp Unidentified	0.8	<.1	54	0.1
Weathervane Scallop (Platinopecten caurinus)	0.5	<.1	2	<.1
Squid Unidentified	0.4	<.1	2	<.1
Scaleworm Unidentified (Polynoidae)	0.3	<.1	7	<.1
Sea Mouse Unidentified (Aphroditidae)	0.1	<.1	1	<.1
Totals	72996.3	100.0	50509	100.0

Table 4. Summary of catch by species in midwater Marinovich trawls from the eastern Bering Sea shelf obtained during the summer 1991 EIMWT survey, _Continuity_ cruise 91-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Jellyfish Unidentified (Scyphozoa)	2788.6	98.1	-	-
Walleye Pollock Age-0 (_Theragra chalcogramma_)	49.4	1.7	19478	99.1
Walleye Pollock (_Theragra chalcogramma_)	2.1	0.1	10	<.1
Yellowfin Sole (_Limanda aspera_)	1.0	<.1	1	<.1
Pacific Cod (_Gadus macrocephalus_)	0.6	<.1	97	0.5
Pacific Sand Lance (_Ammodytes hexapterus_)	0.4	<.1	60	0.3
Fish Larvae Unidentified	0.2	<.1	3	<.1
Flatfish Unidentified (Pleuronectiformes)	0.1	<.1	3	<.1
Greenling Unidentified (_Hexagrammos_ sp.)	0.1	<.1	1	<.1
Totals	2842.5	100.0	19659	100.0

Table 5. Summary of the numbers of pollock biological samples and measurements from the summer 1991 EIMWT survey of the EBS shelf, Continuity 91-1.

HAUL NO	LENGTH	MATUR	OTOL	FISH WGTS	GONAD WGTS	STOMACH SCANS	LAMPREY[4] SCARS	LIVER& GONAD	AGE 0 US	SAMPLES JAPAN
1	168	40	40	40	0	10	0	0		
2	151	40	40	40	0	7	0	0		
3	322	41	41	41	0	0	0	0		
4	184	71	71	71	0	7	70	0		
5	163	40	40	40	0	4	40	0		
6	52	0	0	0	0	8	0	0		yes
7	237	23	23	23	0	5	0	0		
8	150	0	0	0	0	0	0	0		
9	153	0	0	0	0	0	0	0		yes
10	191	0	0	0	0	0	0	0		yes
11	3	0	0	0	0	3	0	0		
12	177	56	56	56	0	5	0	0		
13	157	0	0	0	0	9	0	0		
14	101	40	40	40	0	0	0	0		
15	24	24	24	24	0	5	24	0		
16	4	0	0	0	0	0	0	0		
17	161	0	0	0	0	0	0	0		yes
18	147	36	36	36	0	4	0	0		
19	198	0	0	0	0	0	0	0	yes	yes
20	0	0	0	0	0	0	0	0		
21	220	40	40	40	0	4	40	0		
22	269	40	40	40	0	3	40	0		
23	313	40	40	40	0	4	40	0		
24	218	40	40	40	0	0	0	0		
25	146	40	40	40	0	4	40	0		
26	279	40	40	40	0	3	40	0		
27	228	0	0	0	0	0	0	0		
28	69	0	0	0	0	0	0	0		
29	313	40	40	40	0	4	0	0		
30	181	39	39	39	0	4	0	0		
31	231	40	40	40	0	4	40	0		
32	254	40	40	40	0	4	0	0		
33	419	40	40	40	0	4	0	0		
34	216	0	0	0	0	0	0	0	yes	yes
35	371	40	40	40	0	4	40	0		
36	423	0	0	0	0	0	0	0		
37	211	40	40	40	0	4	0	0		
38	223	40	40	40	0	4	40	0		
39	309	41	41	41	0	6	41	0		
40	258	70	70	54	0	5	54	16		
41	575	53	53	53	0	5	52	0		
42	0	0	0	0	0	0	0	0		
43	213	0	0	0	0	0	0	0		
44	288	42	42	42	0	4	42	0		
45	403	49	49	49	0	0	48	0		
46	204	28	28	14	0	0	14	14		
47	333	56	56	40	0	3	40	16		
48	525	0	0	0	0	0	0	0		
49	205	47	47	47	0	0	47	0		
50	258	63	63	49	0	0	49	14		

[4] Numbers in this column represent fish examined for scars.

Table 5 (continued). Summary of the numbers of pollock biological samples and measurements from the summer 1991 EIMWT survey of the EBS shelf, Continuity 91-1.

HAUL NO	LENGTH	MATUR	OTOL	FISH WGTS	GONAD WGTS	STOMACH SCANS	LAMPREY SCARS	LIVER& GONAD	AGE 0 SAMPLES US	AGE 0 SAMPLES JAPAN
51	214	30	30	30	0	0	30	0		
52	380	65	65	50	7	4	0	15		
53	384	39	39	0	0	0	38	0		
54	581	40	40	40	2	4	40	0		
55	163	0	0	0	0	0	0	0	yes	yes
56	397	0	0	0	0	0	0	0		
57	255	52	52	52	0	0	0	0		
58	269	39	39	39	0	0	0	0		
59	175	0	0	0	0	0	0	0	yes	yes
60	75	6	6	6	0	0	0	0	yes	yes
61	403	44	44	41	1	0	0	0		
62	301	51	51	51	0	0	51	0		
63	469	40	40	40	0	5	40	0		
64	290	41	41	41	2	5	41	0		
65	404	40	40	0	0	0	0	0		
66	556	22	22	0	0	0	22	0		
67	108	0	0	0	0	0	0	0	yes	yes
68	304	75	75	45	13	5	45	30		
69	285	0	0	0	0	0	0	0		
70	205	0	0	0	0	0	0	0	yes	yes
71	0	0	0	0	0	0	0	0		
72	253	0	0	0	0	0	0	0		
73	421	62	62	30	1	3	30	32		
TOT	17790	2065	2065	1824	26	166	1178	137		

Table 6. Inventory of CTD casts, Continuity 91-1.

CAST	HAUL	DATE (1991)	TIME (ADT)	POSITION LAT (N)	POSITION LONG (W)	DEPTH (m) CAST/BOTT	COMMENT
1	-	Jun 25	0909	57 10.9	153 28.7	28/54	Cal. 3 St.Bay
2	-	Jun 26	1407	57 10.9	153 28.7	39/54	Cal. 3 St.Bay
3	1	Jun 30	1211	55 48.9	163 24.2	31/88	Abort cast
4	2,3	Jul 02	0928	56 12.5	164 35.9	77/90	Trans 4
5	4	Jul 03	0129	54 40.8	165 08.5	77/86	Trans 5
6	5,6	Jul 04	1103	55 28.3	165 45.9	114/117	Trans 6
7	7,8	Jul 05	1116	55 32.2	166 22.1	117/130	Trans 7
8	9	Jul 05	2207	56 27.7	166 25.5	91/97	Trans 7
9	10-12	Jul 06	0932	56 56.9	167 06.3	61/75	Trans 8
10	13	Jul 06	2157	56 18.6	166 59.5	102/112	Trans 8
11	14	Jul 07	0935	55 31.4	166 58.6	125/137	Trans 8
12	15	Jul 10	1335	55 06.6	167 32.1	233/237	Trans 9
13	16	Jul 11	1129	57 35.6	167 37.6	63/73	Trans 9
14	17	Jul 11	1644	57 39.4	168 29.5	68/67	Trans 10
15	18	Jul 12	1424	55 53.2	168 12.0	130/139	Trans 10
16	19	Jul 14	2150	56 13.1	170 02.7	102/115	Trans 13
17	20	Jul 15	1523	58 01.0	170 22.5	68/73	Trans 13
18	21	Jul 16	1209	57 22.3	170 51.1	80/82	Trans 14
19	22	Jul 17	1244	56 35.3	171 18.0	112/122	Trans 15
20	23	Jul 19	0608	57 51.6	172 12.2	96/104	Trans 16
21	24	Jul 19	1119	57 26.5	172 07.6	97/105	Trans 16
22	25,26	Jul 20	0800	56 59.1	172 37.2	112/124	Trans 17
23	27	Jul 20	1950	57 32.4	172 45.2	112/117	Trans 17
24	28,29	Jul 21	1350	58 48.6	173 03.0	105/109	Trans 17
25	30	Jul 24	0826	58 18.1	173 32.8	108/113	Trans 18
26	31	Jul 24	1253	57 56.7	173 29.3	114/120	Trans 18
27	32	Jul 25	1621	58 29.7	174 09.5	128/135	Trans 19
28	33	Jul 26	0123	59 21.5	174 25.5	113/122	Trans 19
29	34	Jul 26	1103	59 40.4	174 30.3	106/113	Trans 19
30	35	Jul 27	1203	59 32.0	174 09.7	118/128	Trans 20
31	36,37	Jul 28	1318	58 09.4	173 49.4	112/117	Trans 18.5
32	38	Jul 29	1042	56 38.9	172 49.2	139/146	Trans 17.5
33	39	Aug 02	1905	59 11.7	175 41.6	133/143	Trans 21
34	40	Aug 03	1036	59 43.7	175 55.3	133/141	Trans 21
35	41	Aug 03	2332	60 50.0	176 13.3	113/119	Trans 21
36	42	Aug 04	1902	61 54.0	176 32.5	101/106	Trans 21
37	43	Aug 05	1103	60 50.5	176 54.1	120/128	Trans 22
38	44,45	Aug 06	1718	58 37.2	176 09.2	147/155	Trans 22
39	46	Aug 07	1516	59 02.3	176 57.4	134/143	Trans 23
40	47	Aug 08	0134	60 00.0	177 20.4	128/141	Trans 23
41	48	Aug 08	2122	61 05.2	177 40.3	135/143	Trans 23
42	49,50	Aug 09	1313	60 33.1	178 08.8	154/163	Trans 24
43	51	Aug 10	0924	58 36.6	177 07.3	233/245	Trans 24.1
44	52,53	Aug 11	1500	61 15.8	177 23.5	116/132	Trans 22.5
45	54	Aug 12	0848	60 16.7	175 43.2	109/123	Trans 20.5
46	56	Aug 13	0050	58 57.2	175 18.5	117/135	Trans 20.5
47	57	Aug 14	1420	57 43.9	172 40.7	97/117	Trans 20.6
48	58	Aug 17	0342	58 43.0	173 58.2	124/137	Trans 18.5
49	59	Aug 18	1128	58 14.0	172 40.6	91/108	Trans 16.5
50	60	Aug 20	2319	57 29.4	171 11.4	83/ 95	Trans 14.5
51	61	Aug 21	0208	57 34.6	171 12.6	85/ 95	Trans 14.5
52	62	Aug 22	2007	55 38.5	168 28.9	132/145	Trans 10.5
53	63	Aug 24	1209	55 38.1	167 17.1	125/139	Trans 8.5
54	64	Aug 24	1719	55 16.1	167 15.3	130/148	Trans 8.5

55	65	Aug 24	2131	55 05.6	167 14.4	135/165		Trans 8.5
56	66	Aug 26	1332	56 45.3	165 20.4	65/ 81		Trans 6.6
57	67	Aug 26	1938	56 33.8	164 53.8	61/ 82		Trans 4.5
58	68	Aug 27	0824	55 13.2	164 52.5	97/113		Trans 4.5
59	69	Aug 28	0502	56 26.5	163 42.0	71/ 86		Trans 2.5
60	70	Aug 28	1241	56 40.7	163 42.0	66/ 77		Trans 2.5
61	71	Aug 28	1831	56 57.0	163 41.6	56/ 70		Trans 2.5
62	72,73	Aug 29	1028	55 28.7	165 21.7	/116		No data
63	--	Aug 30	2050	53 40.5	166 51.2	98/110	Cal.	Anderson

Table 7. Inventory of XBT drops, Continuity 91-1.

DROP NO.	HAUL	DATE (1991)	TIME (ADT)	POSITION LAT (N)	POSITION LONG (W)	DEPTH BOTTOM (m)	COMMENTS
1	-			NO DATA			
2	1	Jun 30	1623	56 13.8	163 23.4	84	Trans 1
3	-	Jul 01	1351	55 19.9	163 59.7	73	Trans 3
4	-	Jul 01	1903	55 50.0	164 00.0	53	Trans 3
5	-	Jul 01	2312	56 20.0	164 00.0	90	Trans 3
6	-	Jul 02	0152	56 39.5	164 00.0	77	Trans 3
7	-	Jul 02	0159	56 40.0	164 01.0	77	Trans 3
8	-	Jul 02	2255	54 40.0	165 09.0	80	Trans 5
9	-	Jul 03	1306	55 24.0	165 10.0	113	Trans 5
10	-			NO DATA			Bad probe
11	-			NO DATA			Bad probe
12	-	Jul 03	1750	55 58.0	165 11.0	95	Trans 5
13	-	Jul 03	2233	56 38.0	165 12.0	75	Trans 5
14	-	Jul 04	2158	54 39.0	166 19.0	329	Trans 7
15	-	Jul 05	0235	55 17.0	166 21.0	132	Trans 7
16	-	Jul 05	1600	55 58.0	166 23.0	124	Trans 7
17	-	Jul 05	2246	56 29.0	166 25.0	95	Trans 7
18	-	Jul 06	0641	57 11.4	167 06.2	74	Trans 8
19	-	Jul 10	1611	55 24.0	167 33.0	141	Trans 9
20	-	Jul 10	2121	56 04.0	167 37.0	132	Trans 9
21	-	Jul 11	0257	56 44.0	167 40.0	93	Trans 9
22	-	Jul 11	0812	57 25.0	167 44.0	71	Trans 9
23	-			NO DATA			Bad probe
24	-			NO DATA			Bad probe
25	-			NO DATA			Bad probe
26	-	Jul 13	0037	55 36.0	168 42.0	524	Trans 11
27	-	Jul 13	0733	56 44.0	167 40.0	110	Trans 11
28	-	Jul 13	1357	57 12.0	168 58.0	71	Trans 11
29	-	Jul 13	1729	57 38.0	169 01.0	66	Trans 11
30	-			NO DATA			Bad probe
31	-			NO DATA			Bad probe
32	-			NO DATA			Bad probe
33	-			NO DATA			Bad probe
34	-	Jul 14	1911	55 57.0	170 00.0	630	Trans 13
35	-	Jul 15	0908	57 21.0	170 21.0	57	Trans 13
36	-	Jul 18	1700	59 19.0	172 27.5	86	Trans 16
37	-	Jul 19	0021	58 22.9	172 18.2	101	Trans 16
38	-	Jul 19	2006	56 27.7	172 05.8	1000	Trans 16
39	-	Jul 25	0738	57 25.7	173 58.2	500	Trans 19
40	-	Jul 25	1329	58 14.2	174 09.9	134	Trans 19
41	-	Jul 25	2116	59 03.0	174 21.9	124	Trans 19
42	-	Jul 26	1338	59 53.8	174 34.3	110	Trans 19
43	-	Aug 01	2232	58 11.8	175 25.5	1000	Trans 21
44	-	Aug 02	1448	58 58.2	175 38.6	134	Trans 21
45	-	Aug 03	0049	59 42.3	175 52.6	137	Trans 21
46	-	Aug 03	1755	60 28.7	176 07.5	123	Trans 21
47	-	Aug 04	1455	61 34.9	176 26.4	104	Trans 21
48	-	Aug 06	2256	58 27.9	176 43.4	1200	Trans 23
49	-	Aug 07	2306	59 55.4	177 15.8	135	Trans 23
50	-	Aug 08	1500	60 43.1	177 32.1	146	Trans 23
51	-	Aug 09	0128	61 31.4	177 49.2	139	Trans 23
52	55	Aug 12	1414	59 52.3	175 35.2	130	Trans 20.5
53	-	Aug 16	1244	57 06.5	173 35.0	210	Trans 18.5
54	-	Aug 19	1019	56 12.1	170 56.9	180	Trans 14.5

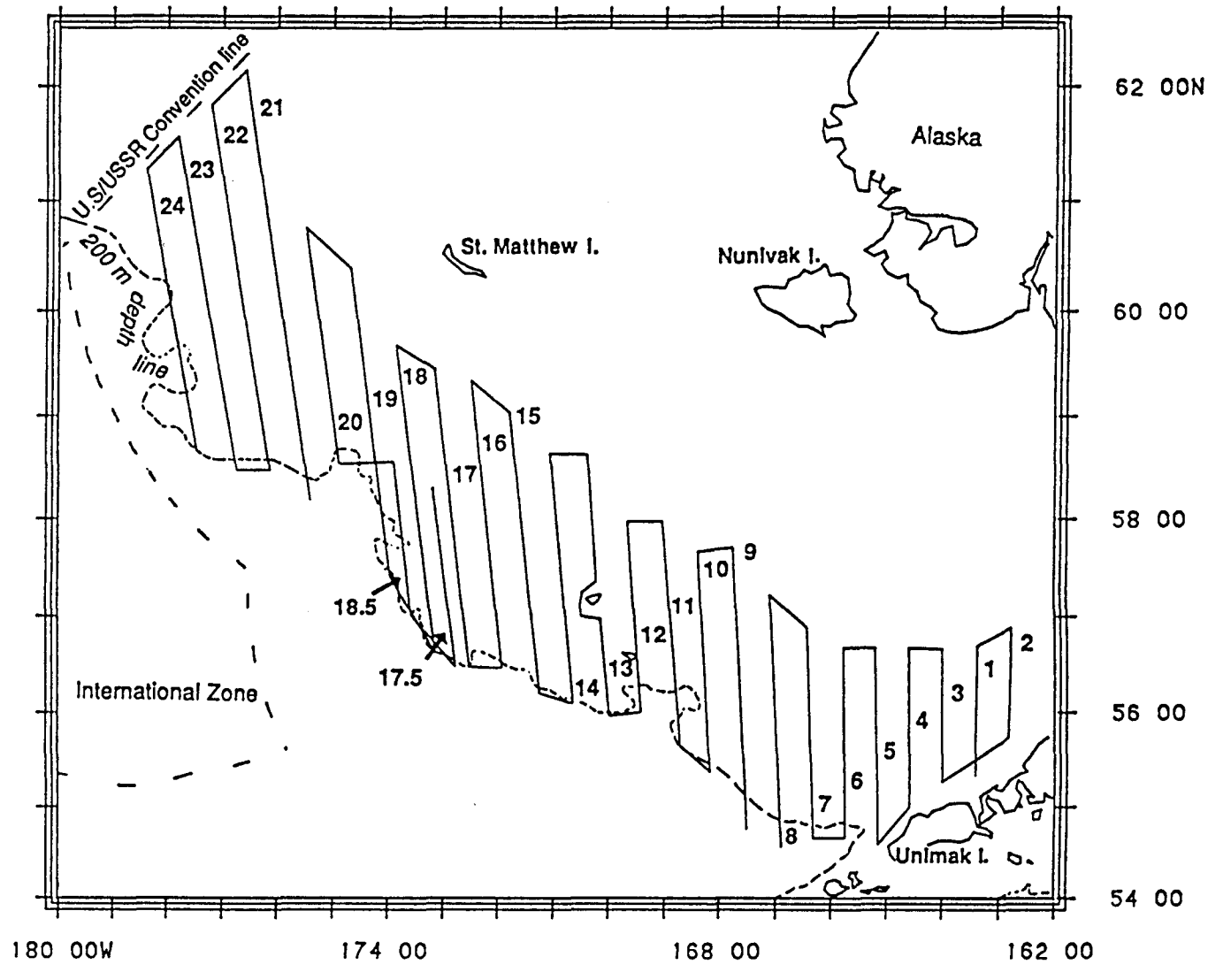

Figure 1. Primary survey trackline of the summer 1991 EIMWT survey of the EBS shelf, Continuity cruise 91-1.

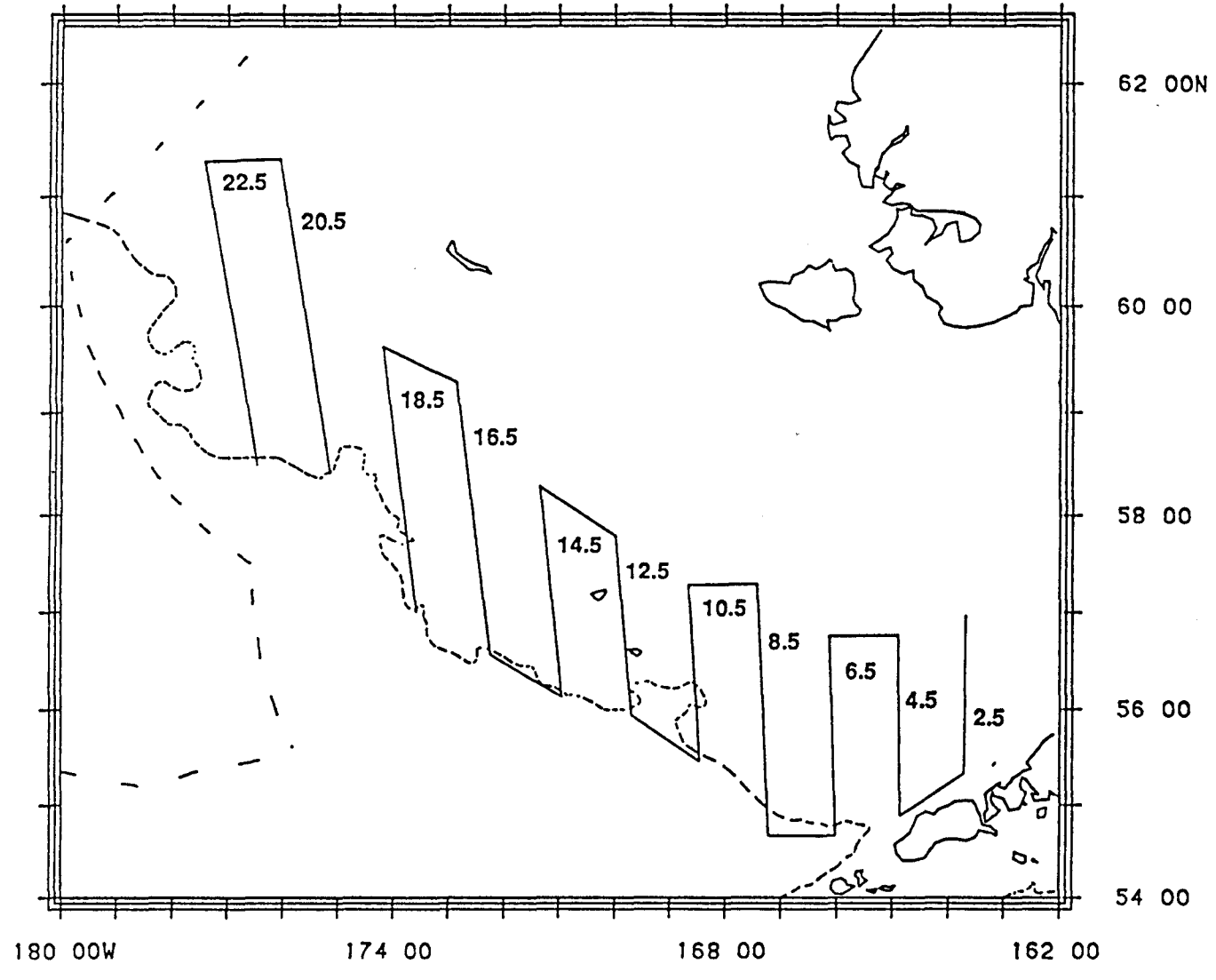

Figure 2. Replicate survey trackline of the summer 1991 EIMWT survey of the EBS shelf, Continuity cruise 91-1.

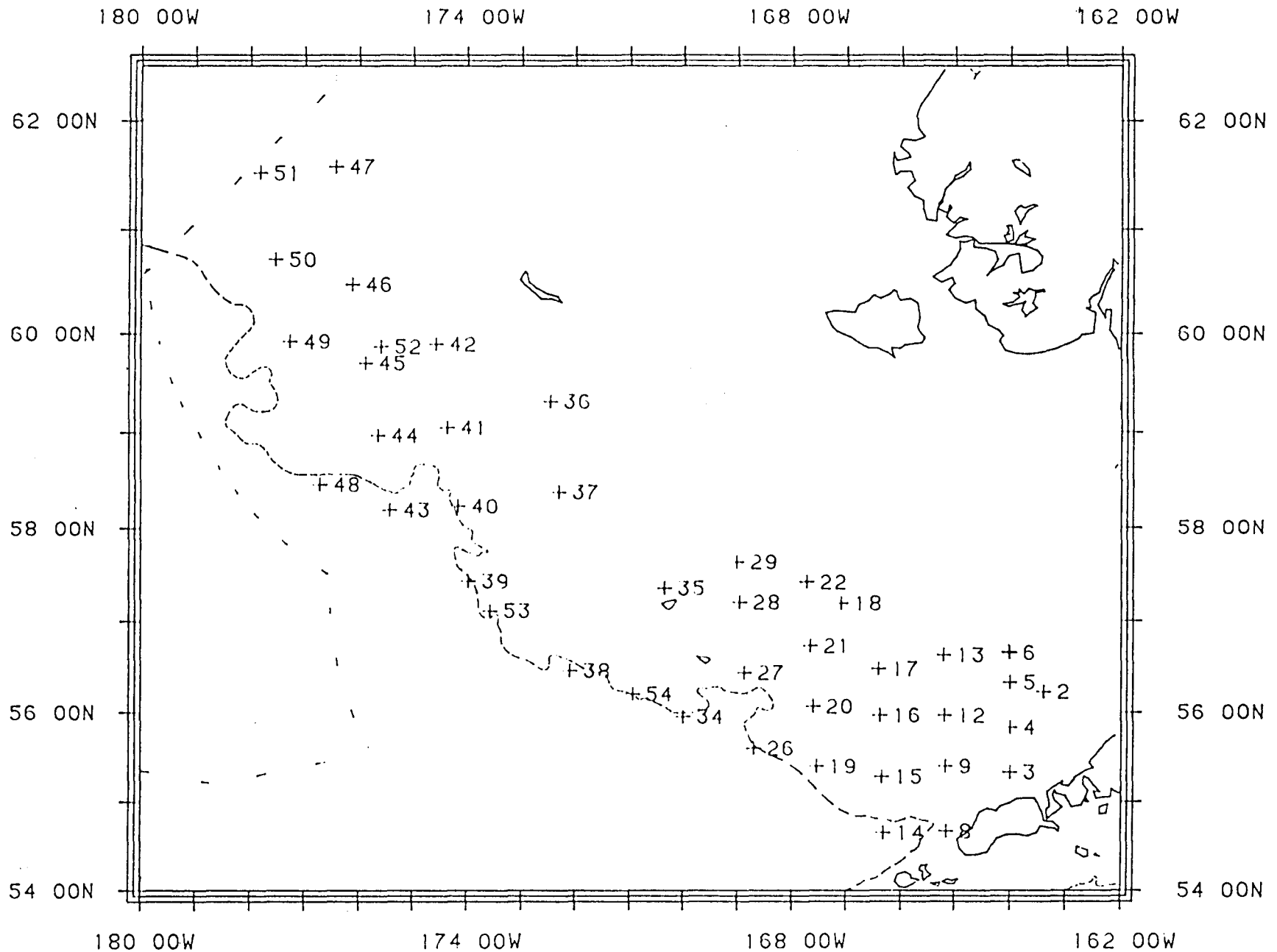

Figure 3. XBT cast locations for the summer 1991 EIMWT surveys of the EBS shelf, Continuity cruise 91-1.

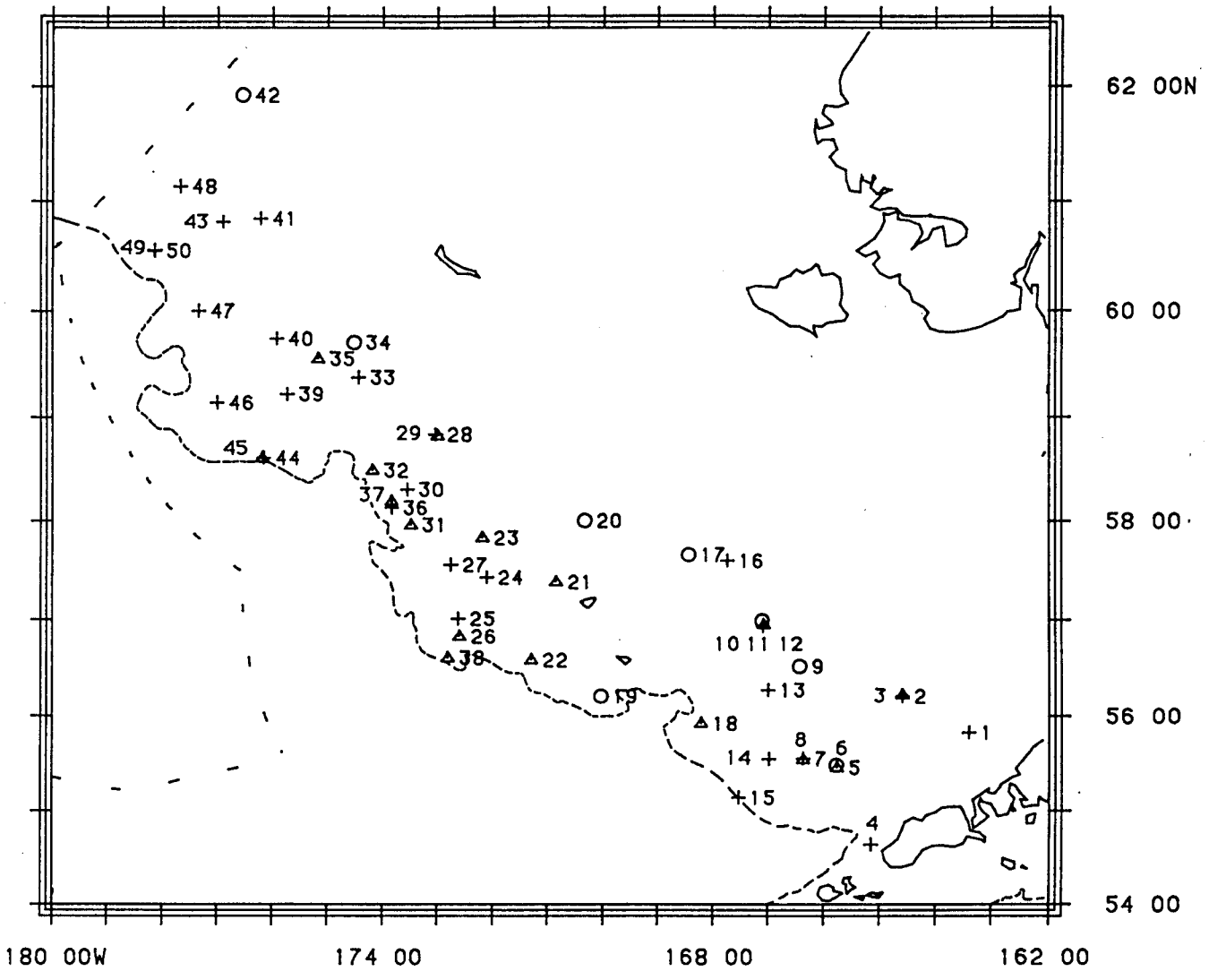

Figure 4. Trawl haul locations for the primary EIMWT survey, Continuity cruise 91-1. Midwater rope trawl (+), bottom trawl (△), and Marinovich midwater trawl (o).

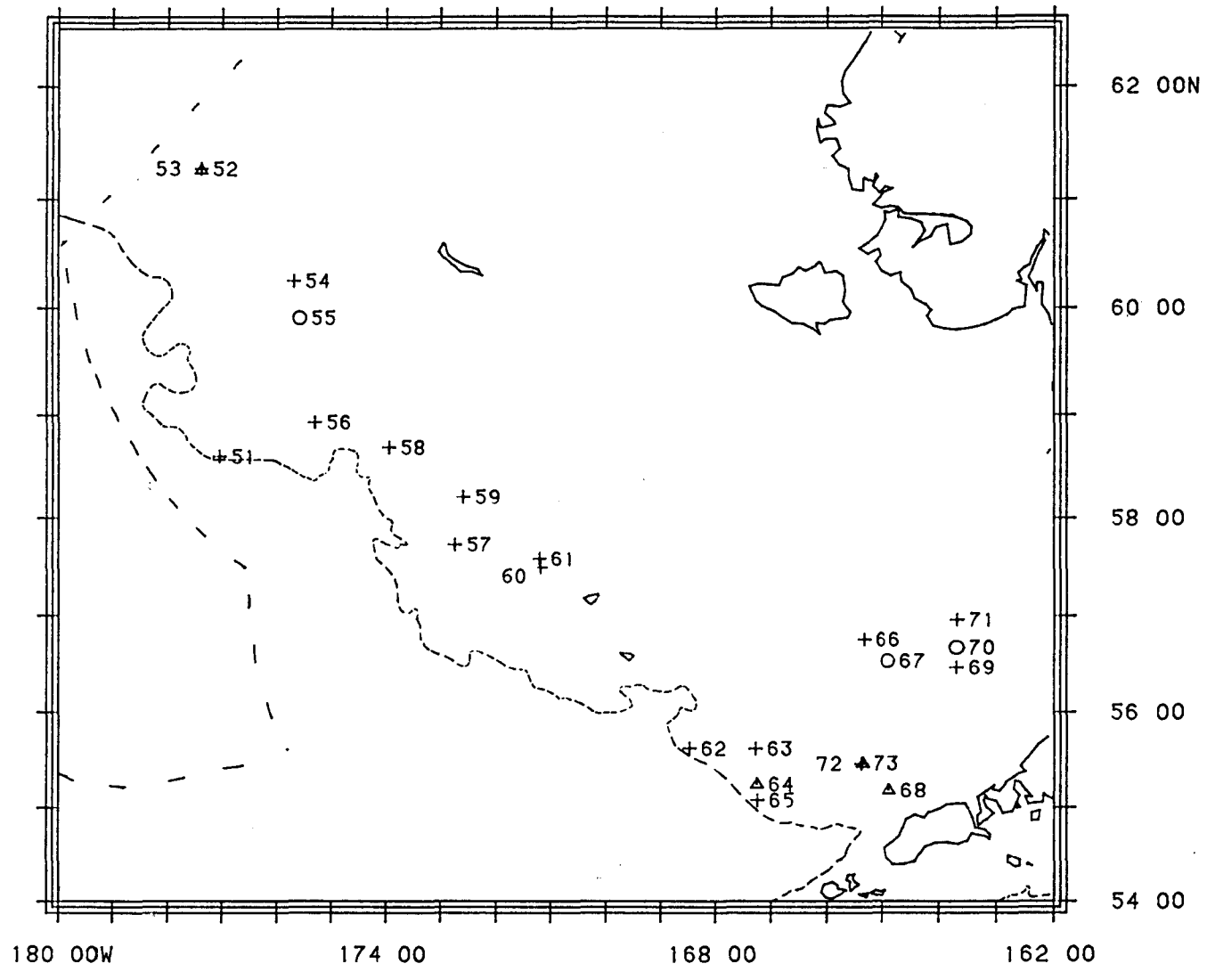

Figure 5. Trawl haul locations for the replicate EIMWT survey, Continuity cruise 91-1. Midwater rope trawl (+), bottom trawl (▲), and Marinovich midwater trawl (o).

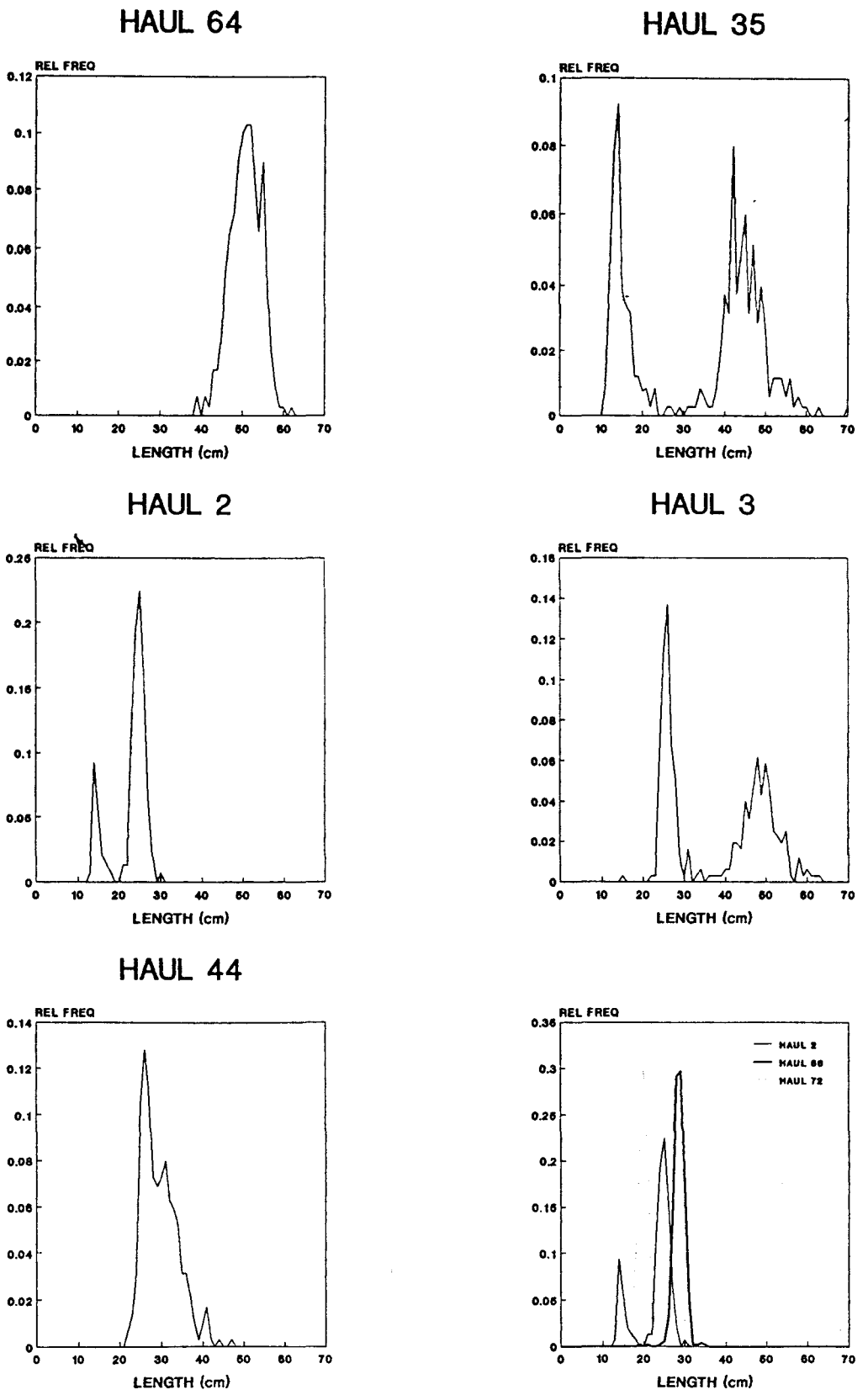

Figure 6. Representative pollock size compositions from demersal (Hauls 3, 35, 64) and midwater (Hauls 2, 44, 66, 72) trawl catches on the EBS shelf, Continuity cruise 91-1.